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PROBLEMS OF TREATING WATER CONTAINING A ROTENONE
PREPARATION (CHEM FISH REGULAR, AN EMULSIFIED
ROTENONE PREPARATION) USED IN FISHERY MANAGEMENT
SUPPLEMENT

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CINCINNATI, OHIO

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PROBLEMS OF TREATING WATER
CONTAINING A ROTENONE PREPARATION*
USED IN FISHERY MANAGEMENT

*CHEM FISH REGULAR
AN EMULSIFIED ROTENONE PREPARATION

SUPPLEMENT

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
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* * *

SUPPLEMENT

* * *

Introduction

This report presents additional data on the removal of Chem Fish Regular rotenone formulation from water. These data supplement the detailed report entitled, "Problems of Treating Water Containing a Rotenone Preparation* Used in Fishery Management", issued February 4, 1957. In this first report it was recommended that a rotenone preparation which did not use the hydrocarbon solvent (methylated naphthalene) would offer fewer problems at the water plant. In view of this recommendation, the manufacturer offered to change the solvent to a hydrocarbon type which has a lower boiling range and contains less odorous materials. A new Chem Fish Regular sample, marked HFN, was received from the manufacturer. This preparation was identical to the previous sample tested except for

*Chem Fish Regular, an emulsified rotenone preparation

the change in solvent. Comparative tests with the original preparation were undertaken to determine whether the new solvent was preferable.

Objective

In the previous report, it was assumed that practically all of the solvent would have to be removed in order to produce potable water. This removal was effectively accomplished by treatment with active carbon. It was also shown that hydrocarbon odor was reduced on standing. These two tests, then, formed the bases for comparing samples containing the different solvents.

Experimental

Method

Solutions containing 2.05 p.p.m. of the two Chem Fish Regular formulations in odor-free Cincinnati tap water were treated with increasing amounts of active carbon for 30 minutes with mechanical stirring. Suspended carbon was removed on fritted glass filters and the effluent checked for odor remaining. Since odor measurement was the only basis for these comparative tests, and since odor measurement, at best, is not a precise determination, steps were taken to make this test as accurate as possible with the staff and time available.

A panel of four observers was used to determine the threshold odor number for each sample. Odor determinations were made at room temperatures ranging from 23 - 25° C. The geometric

mean of the responses of the four panel members for each sample was calculated to give the average threshold odor number for that sample.

Carbon Treatment

The threshold odor concentration, i.e. the average minimum concentration of the preparations which could be detected by the odor panel was found to be:

Chem Fish Regular 27 p.p.b.

Chem Fish Regular HFN 128 p.p.b.

The original solvent is almost five times as odorous as the new preparation.

Data obtained on the treatment of the two samples with increasing amounts of active carbon are shown in Table 1.

Table 1

Effect of carbon on removal of odor from
solutions containing 2.05 p.p.m. of
Chem Fish Regular

Carbon added p.p.m.	Average threshold odor number remaining	
	Chem Fish Regular	Chem Fish Regular HFN
0	76	16
5	23	--
10	6.7	4.8
15	4.8	2.8
20	2.8	1.7
25	2.0	1.4
30	1.0	1.6
35	1.4	2.8
40	1.4	--
50	1.2*	1.2*

* Odor determination made at 50° C.

These results, also shown in Figure 1, indicate that the major portion of the odor is removed by relatively small amounts of carbon (15-20 p.p.m.) but that a small residual odor persists in spite of greatly increased carbon additions. The data, when plotted according to the Freundlich adsorption equation (not included in this report), shows a linear relationship between odor remaining and carbon added. With the addition of 35 p.p.m. of carbon to Chem Fish Regular HFN, two of the four observers were unable to detect any odor, although two individuals raised the average threshold odor number to the indicated value.

Most hydrocarbon odors are more easily detected as the temperature of the samples being tested is raised. For this reason, the Chem Fish Regular solutions which had been treated with 50 p.p.m. carbon were tested for odor remaining at the elevated temperature of 50° C. As indicated in Table 1, both solutions had an average threshold odor number of 1.2. Results of this test imply that even though large doses of carbon may be used, odor will be detected by some consumers, particularly during use of hot water.

The curves in Figure 1 also show that moderate amounts of carbon (25-30 p.p.m.) reduce the odor of both solvents to essentially the same point, indicating that, considering carbon treatment alone, there is no clear choice between the two solvents, even though the threshold odor concentration of Chem Fish Regular is almost five times as great as for Chem Fish Regular HFN.

Standing Experiment

To determine the comparative rates of odor disappearance of the two Chem Fish Regular compounds, 2.05 p.p.m. solutions in odor-free tap water were put into wide-mouth gallon jars and loosely covered with a watch glass. No attempt was made to duplicate field experience. All that was desired here was to determine the odor persistence of the two formulations (Table 2).

Table 2

Stability of 2.05 p.p.m. Chem Fish Regular
solutions on standing

Elapsed time days	Temp. °C.	Average threshold odor number remaining	
		Chem Fish Regular	Chem Fish Regular HFN
0	22	76	16
1	25	32	8.0
2	24.5	13	5.7
5	24	4.0	0.6
7	23.5	1.7	0

These data are also shown in Figure 2. It is quite clear that the solvent used in the new Chem Fish Regular HFN preparation disappears more rapidly upon standing than does the original solvent. At the end of 5 days, no odor was detected in the Chem Fish Regular HFN sample by three of the four observers. Detection of odor by the most sensitive member of the panel resulted in the low average threshold odor value of 0.6. After seven days none of the panel could detect an odor in the solution of Chem Fish Regular HFN. At the end of this same period, odor due to Chem Fish Regular was readily detected by all observers.

On the basis of persistence, the choice of solvent would obviously lie with Chem Fish Regular HFN. Under the laboratory conditions described this material could be expected to be dissipated at the end of five days, whereas strong odor was still detectable with the original solvent at the end of seven days.

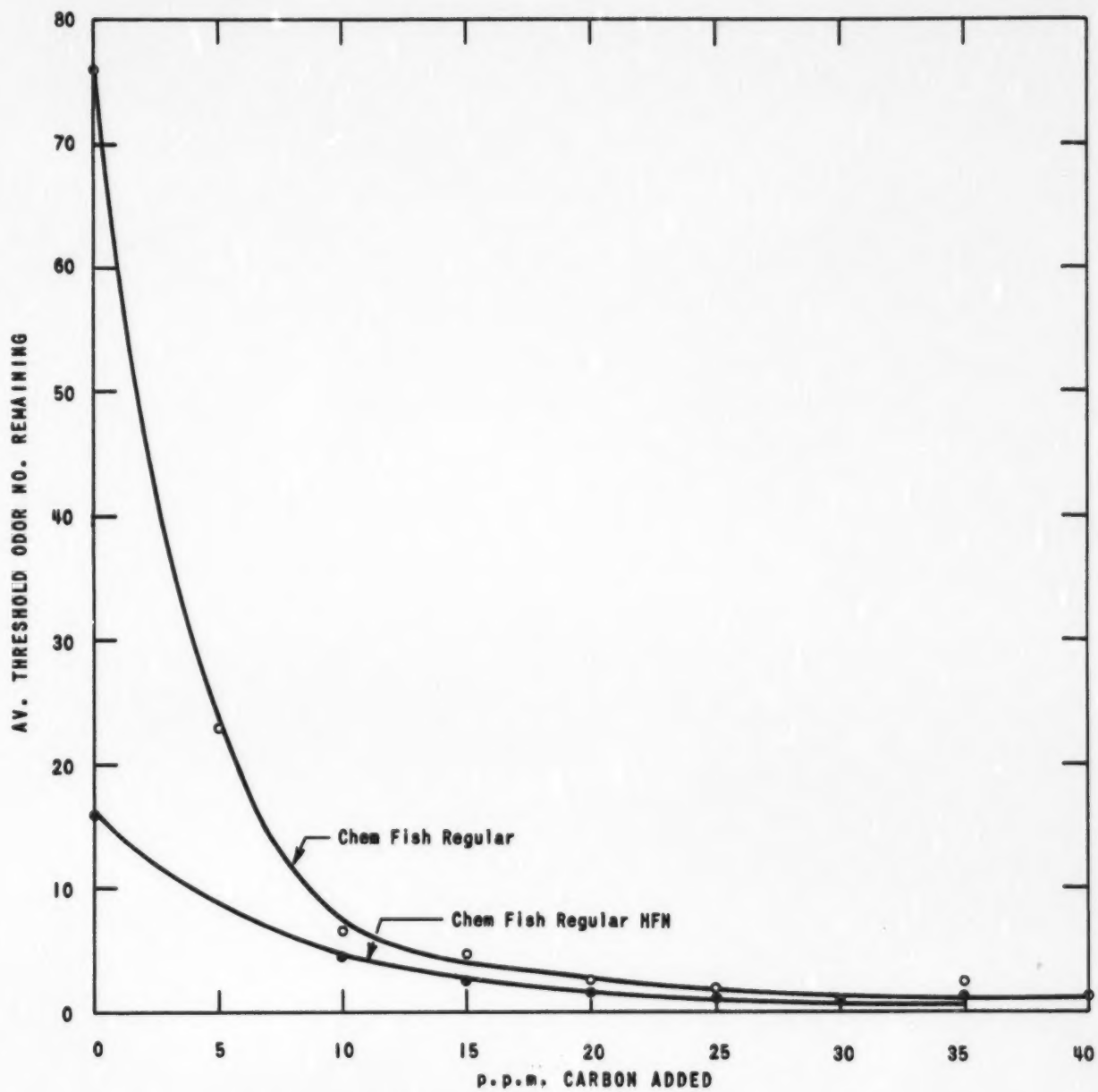
Summary

Two Chem Fish Regular rotenone preparations, differing only in the kind of solvent used, were compared to determine which one was preferable in the Dickinson Reservoir application, where a fish eradication project was planned. The two preparations were checked for ease of odor removal by carbon and for persistence of odor on standing.

The average threshold odor concentrations of Chem Fish Regular and Chem Fish Regular HFN were 27 and 128 p.p.b., respectively. Odor due to 2.05 p.p.m. solutions of these compounds can be reduced to very low threshold odor numbers by 25-30 p.p.m. of active carbon. Further additions of carbon result in only slight additional reductions in odor remaining. This behavior is typical of the process of adsorption by active carbon. The very small residual odor following carbon treatment will probably not be detectable by most people, although certain sensitive individuals may be aware of the presence of hydrocarbon. In the first few days following Chem Fish Regular application, some odor complaints may be expected.

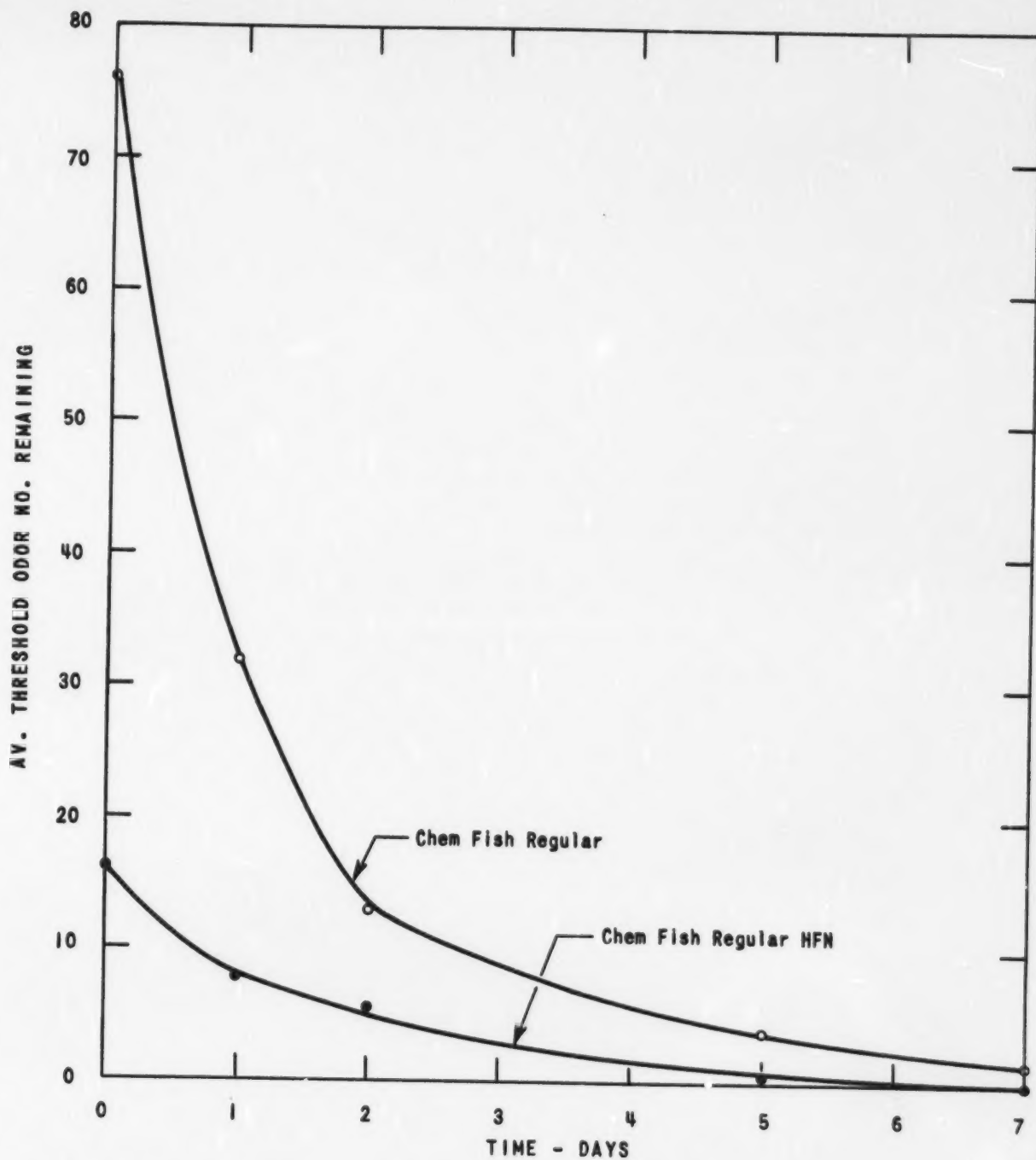
In spite of the fact that the new solvent is one-fifth as odorous as the old, only very slight differences could be detected after carbon treatment. The residual odor after treatment with 25-30 p.p.m. carbon was essentially identical with both formulations.

A wide difference was observed, however, in the persistence of the two formulations. The new preparation, Chem Fish Regular HFN actually went to zero threshold odor number in seven days under laboratory conditions, while the odor of the original preparation was still easily detected by all panel members. On the basis of persistence, the new preparation is preferable to the original since odor duration at the water plant can be expected to be shorter. Somewhat longer persistence can be anticipated under field conditions than was found in the laboratory due to the lower ratio of surface area to volume in the lake than in the laboratory.



REMOVAL OF ODOR FROM 2.05 p.p.m. CHEM FISH SOLUTIONS BY ACTIVE CARBON

Figure 1



REDUCTION OF THRESHOLD ODOR NO. OF 2.05 p.p.m. SOLUTIONS OF CHEM FISH ON STANDING TEMP. 22-25° C

Figure 2